

Notice of Allowability

Application No.

10/749,167

Examiner

Tiffany A Fetzner

Applicant(s)

BRITTAİN, JEAN HELEN

Art Unit

2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 07/02/2004.
2. ☒ The allowed claim(s) is/are 31-50.
3. ☒ The drawings filed on 30 December 2003 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date 04/06/2004
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date 09/17/2004.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Examiner's Amendment

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with **Attorney J. Mark Wilkinson Reg. No. 48,865** on September 17th 2004 along with authorization to charge any necessary fees to applicant's deposit account.
3. The application has been amended as follows:

A) Replace claim 31 with the following Examiner amended claim 31:

Claim 31 --- A method of imaging large volumes without resulting slab-boundary artifacts comprising:

defining a desired FOV larger than an optimal imaging volume of an MR scanner;
selecting a slab thickness in a first direction that is smaller than the desired FOV and within the optimal imaging volume of the MR scanner; and

continuously moving one of the optimal imaging volume and an imaging object in the first direction while repeatedly exciting and encoding spins with readout in the first direction to acquire data that is restricted to the selected slab thickness until at least one image of the FOV can be reconstructed;

processing MR data to account for accrued phase resulting from table velocity;
transforming MR data in a z-direction;
correcting the MR data for spatial variations in the magnetic field in the direction of motion;

removing unnecessary data at the beginning and ending of each acquisition; and
sorting, interpolating, and

aligning the transformed MR data to match anatomic locations in the first direction. ---

B) Replace claim 33 with the following Examiner amended claim 33:

Claim 33 --- The method of claim 31 further comprising gridding the z-transformed MR data in dimension(s) perpendicular to the first direction to reconstruct an MR image. ---

C) Replace claim 45 with the following Examiner amended claim 45:

Claim 45 --- "An MRI apparatus **which acquires** multiple sets of MR data with a moving table and reconstructs MR images without slab-boundary artifacts comprising:

a magnetic resonance imaging (MRI) system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field, **and** an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly **and** [to] acquire MR images;

a patient table movable fore and aft in the MRI system about the magnet bore
and

a computer programmed to:

receive input defining a desired FOV larger than an optimal imaging volume of the MRI system;

accelerate the patient table to the constant velocity before a leading edge of the FOV reaches a slab fixed in position with respect to a magnet of the medical image device;

acquire full MR data with readout in a direction of table motion;

continuously move the patient table at the desired constant velocity while maintaining position of the fixed slab; and

repeat the acquisition of full MR data for a number of table positions while the patient table is moving until an MR data set is acquired across the desired FOV to reconstruct an image of the FOV. ---

D) Replace claim 50 with the following Examiner amended claim 50:

Claim 50 --- A computer program configured to control a medical image scanner and create images across scanning boundaries without boundary artifacts, the computer program having a set of instructions to control a computer to:

select an FOV spanning an area greater than a predefined optimal imaging area of the medical image scanner;

determine a constant velocity by which to continuously translate a patient table about a magnet bore of the medical image scanner;

position the patient table at a location inferior or superior to the desired FOV;

accelerate the patient table to the constant velocity before a leading edge of the FOV reaches a slab fixed in position with respect to a magnet of the medical image device;

play out RF and gradient waveforms during patient table acceleration to establish steady-state in the FOV;

acquire full MR data with readout in a direction of table motion;

continuously move the patient table at the desired constant velocity while maintaining position of the fixed slab; and

repeat the acquisition of full MR data for a number of table positions while the patient table is moving until an MR data set is acquired across the desired FOV to reconstruct an image of the FOV. ---

Examiner's Comment

4. The examiner notes that the above amended independent claims were amended by the examiner to correct grammatical concerns, and to ensure that the claim limitations, claimed by applicant, are clearly legible, since some of the alphanumeric characters in applicant's July 1st 2004 response were not legible upon scanning.

5. No new matter was added by the examiner's amendments, only formal matters were corrected.

Response to Arguments

6. The applicant's arguments concerning the **Kruger et al.**, reference of July 2nd 2004 have been considered, [See the July 2nd 2004 remarks pages 7 through page 9 paragraph 1]. The examiner considers these arguments to be persuasive for each of the argued independent claims. Therefore, it is the examiner's position that applicant's claims, from the July 2nd 2004 response and the examiner's amendments to the claims provided above successfully overcome the teachings of the **Kruger et al.**, reference as prior art. The **Kruger et al.**, reference is therefore, no longer being applied as prior art against the claims, and all the earlier rejections made which depend on the **Kruger et al.**, reference have been rescinded.

The following is an examiner's statement of **Reasons for Allowance**:

7. With respect to **examiner amended claims 31-44**, These claims are allowable over the **prior art of record** because the **prior art of record** does not disclose or suggest an MRI method (i.e. **claim 31**) that images large volumes without slab-boundary artifacts by "continuously moving one of the optimal imaging volume and an imaging object in the first direction while repeatedly exciting and encoding spins with readout in the first direction to acquire data that is restricted to the selected slab thickness until at least one image of the FOV can be reconstructed; processing MR data to account for accrued phase resulting from table velocity; transforming MR data in a z-direction; correcting the MR data for spatial variations in the magnetic field in the direction of motion; removing unnecessary data at the beginning and ending of each acquisition; and sorting, interpolating, and aligning the transformed MR data to match anatomic locations in the first direction", in combination with each and every remaining limitation of this claim, as set forth by applicant. **It is the entire combination of taken as a whole** that constitutes both the novelty and non-obviousness of **claim 31**, as provided above.

8. With respect to **examiner amended claims 45-49**, these claims are allowable over the **prior art of record** because the **prior art of record** does not disclose or suggest an MRI apparatus (i.e. **claim 45**) that images large volumes without slab-boundary artifacts by having the computer of the MR apparatus "accelerate the patient table to a constant velocity before a leading edge of the FOV reaches a slab fixed in position with respect to a magnet of the medical image device; acquire full MR data with readout in a direction of table motion; continuously move the patient table at the desired constant velocity while maintaining position of the fixed slab; and repeat the acquisition of full MR data for a number of table positions while the patient table is moving until an MR data set is acquired across the desired FOV to reconstruct an image of the FOV", in combination with each and every remaining limitation of this claim, as set forth by applicant. **It is the entire combination of taken as a whole** that constitutes both the novelty and non-obviousness of claim 31, as provided above.

9. With respect to **examiner amended claim 50**, This claim is allowable over the **prior art of record** because the **prior art of record** does not disclose or suggest a computer program configured to control a medical image scanner and create images across scanning boundaries without boundary artifacts", wherein the computer program has a set of instructions to control a computer to: "determine a constant velocity by which to continuously translate a patient table about a magnet bore of the medical image scanner; position the patient table at a location inferior or superior to the desired FOV; accelerate the patient table to the constant velocity before a leading edge of the FOV reaches a slab fixed in position with respect to a magnet of the medical image device; play out RF and gradient waveforms during patient table acceleration to establish steady-state in the FOV; acquire full MR data with readout in a direction of table motion; continuously move the patient table at the desired constant velocity while maintaining position of the fixed slab; and repeat the acquisition of full MR data for a number of table positions while the patient table is moving until an MR data set is acquired across the desired FOV to reconstruct an image of the FOV", in combination with each and every remaining limitation of this claim, as set forth by applicant. **It is the**

entire combination of taken as a whole that constitutes both the novelty and non-obviousness of **claim 50**, as provided above.

10. With respect to **dependent claims 32-44** and **46-49**, these claims are allowable over the prior art of record because they depend respectively from an allowable examiner amended independent claim.

11. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

12. The **prior art made of record** and not relied upon is considered pertinent to applicant's disclosure.

A) Machida US Patent Application Publication US 2002/0115929 A1 published August 22nd 2002 which has an effective filing date available under 35 U.S.C. 102(e) of September 21st 2001. The examiner notes that this reference teaches and shows a two-dimensional application of applicant's **claims 31-50**, which like **Kruger et al.**, constitute a grounds of rejection under 35 USC 103 (a), since applicant's claims include two or three dimensionality. Because applicant is specifically using slabs or three-dimensional slices in the instant application's disclosure the **Kruger et al.**, reference has been applied, however the examiner still considers the **Machida** reference to be applicable relevant prior art, because it has an effective filing date of September 21st 2001.

B) Yoshitome Japanese Laid-open Patent Application (kokai) No. H6-304153 disclosed November 1st 1994. [The examiner is using the English version of this reference provided by applicant in the parent 09/682,699 application.]

C) Yoshitome Japanese Laid-open Patent Application (kokai) No. H6-311977 disclosed November 8th 1994. [The examiner is using the English version of this reference provided by applicant in the parent 09/682,699 application.]

D) Hajnal US patent 6,385,478 B1 issued May 7th 2002, filed December 21st 1999.

- E) Kuhara** US Patent Application Publication US 2002/0021128 A1 published February 21st 2002 which has an effective filing date available under 35 U.S.C. 102(e) of April 25th 2001.
- F) Dumoulin et al.**, US patent 6,584,337 B2 issued June 24th 2003, filed November 21st 2001.
- G) The Dietrich et al.**, article "Extending the coverage of true volume scans by continuous movement of the subject" by Olaf Dietrich and Joseph V. Hajnal from The Robert Steiner Magnetic Resonance Unit, Hammersmith Hospital, Du Cane Road, London W120HS 1999.
- H) Brittain** US Patent Application Publication US 2002/0140423 A1 published October 3rd 2002, which is the corresponding publication of applicant's instant application, therefore this application is not available as prior art, but is noted only for the purposes of a complete record.
- I) Brittain** US Patent Application Publication 2003/0011369 A1 published January 16th 2003, which is the corresponding publication of applicant's co-pending continuation application, 10.235,454 and therefore is not available as prior art, but is noted only for the purposes of a complete record.
- J) Wang** US patent 5,928,148 issued July 27th 1999.
- K) Kruger et al.**, US provisional application 60/282,555 filed April 9th 2001. [See the Notice of references cited. A courtesy copy of the US provisional application 60/282,555 has been provided to applicant.]
- J) Brittain** US Patent Application Publication 2004/0155654 A1 published August 12th 2004, which is the corresponding publication of applicant's instant application, and therefore is not available as prior art, but is noted only for the purposes of a complete record.
- K) Dumoulin et al.**, US patent 6,584,337 B2 issued June 24th 2003 filed November 21st 2001. The reference is noted for the purposes of a complete record, but is not available as prior art because applicant instant application has an earlier United States effective priority date.

L) Dumoulin et al., US Patent Application Publication 2003/0100825 A1 published May 29th 2003, filed November 21st 2001. The reference is noted for the purposes of a complete record, but is not available as prior art because applicant instant application has an earlier United States effective priority date.

M) Welch et al., US patent 6,617,850 B2 issued September 9th 2003 filed December 3rd 2001. The reference is noted for the purposes of a complete record, but is not available as prior art because applicant instant application has an earlier United States effective priority date.

N) Welch et al., US Patent Application Publication 2003/0102864 A1 published June 5th 2003, filed December 3rd 2001. The reference is noted for the purposes of a complete record, but is not available as prior art because applicant instant application has an earlier United States effective priority date.

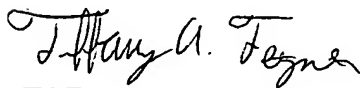
O) Brittain US Patent Application Publication 2004/0155654 A1 published August 12th 2004, which is a separate continuation application which also claims priority to **Brittain** application 09/682,699 filed October 5th 2001, and therefore is not available as prior art, but is noted only for the purposes of a complete record.

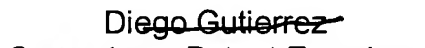
P) Kruger et al., US patent application Publication 2002/0173715 A1 published November 21st 2002; filed November 26th 2001, with an effective US prior art date of April 9th 2001 from the US provisional application 60/282,555 filed April 9th 2001.

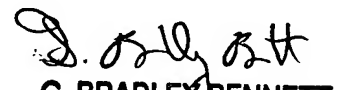
Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

14. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(703) 872-9306**.


TAF
September 16, 2004


Supervisory Patent Examiner
Technology Center 2800


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PRIMARY EXAMINER
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